

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
14 June 2001 (14.06.2001)

PCT

(10) International Publication Number
WO 01/41633 A1

(51) International Patent Classification⁷: A61B 1/32
(21) International Application Number: PCT/US00/33384
(22) International Filing Date: 7 December 2000 (07.12.2000)

(25) Filing Language: English
(26) Publication Language: English
(30) Priority Data:
60/170,330 13 December 1999 (13.12.1999) US

(71) Applicant (for all designated States except US): TYCO
HEALTHCARE GROUP LP [US/US]; 150 Glover Av-
enue, Norwalk, CT 06856 (US).

(72) Inventor; and
(75) Inventor/Applicant (for US only): MAFFEL, Frank, C.
[US/US]; 46 Old Shelton Road, Shelton, CT 06484 (US).

(74) Agent: AUDET, Paul; Tyco Healthcare Group LP, 150
Glover Avenue, Norwalk, CT 06856 (US).

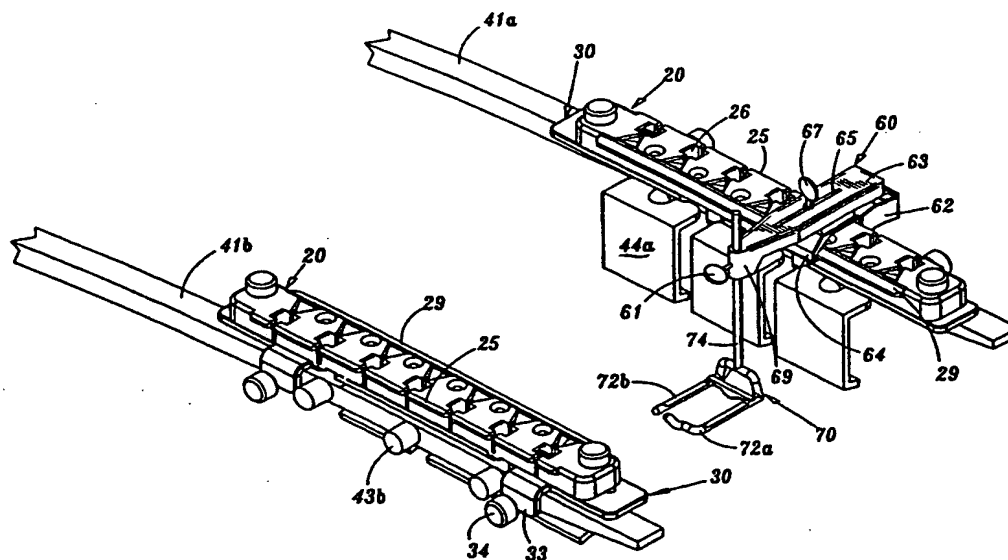
(81) Designated States (national): AL, AM, AT, AU, AZ, BA,
BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES,
FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK,
LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO,
NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT,
UA, UG, US, UZ, VN.

(84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,
CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— With international search report.

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: UNIVERSAL INSTRUMENT BASE ASSEMBLY FOR A RETRACTOR



(57) Abstract: A universal instrument base assembly which is selectively engageable with a surgical retractor (40) includes a mount-
ing plate (30) having a mechanical interface which releasably engages the surgical retractor and an instrument base plate (20) which
includes a first portion which releasably engages the mounting plate and a second portion which releasably engages a surgical in-
strument. The mechanical interface of the mounting plate is adjustable to releasably engage a variety of different surgical retractors.

WO 01/41633 A1

UNIVERSAL INSTRUMENT BASE ASSEMBLY FOR A RETRACTOR

BACKGROUND

The present disclosure relates to cardiovascular and thoracic retractors and, more particularly, to a universal mounting assembly which can be used with a wide variety of different surgical retractors to support surgical instrument holders, sutures and/or other surgical devices during surgery.

Technical Field

Over the past several decades, modern medicine has witnessed tremendous advances in less invasive and less traumatic surgical procedures which has provided numerous physical and economical benefits to the modern patient. One particular area of medicine which has advanced considerably is heart surgery, in particular, heart by-pass surgery. For example, in coronary by-pass surgery or a coronary artery bypass graft ("CABG"), a saphenous vein may be removed from the patient's leg and grafted at one end to the ascending aorta as an arterial blood source and at the other end to a coronary artery at a point beyond the arterial occlusion reestablishing blood flow to the heart muscle. Alternatively, the internal mammary artery located in the thoracic cavity adjacent the sternum is likewise

suitable for grafting to a coronary artery, such as the left anterior descending artery ("LAD").

The performance of a CABG procedure typically requires access to the heart, blood vessels and associated tissue. Access to the patient's thoracic cavity may be achieved in an open procedure by making a large longitudinal incision in the chest. This procedure, referred to as a median sternotomy, requires a saw or other cutting instrument to cut the sternum to allow the two opposing halves of the rib cages to be spread apart to expose the internal organs of the thoracic cavity. A sternum retractor equipped with retractor blades which are positioned within the myocardium is typically used to spread apart the two halves of the incision.

U.S. Pat. No. 5,025,779 to Bugge discloses a retractor which is designed to grip opposite sternum halves and spread the thoracic cavity apart. The large opening which is created by this technique enables the surgeon to directly visualize the surgical site and perform procedures on the affected organs. However, such procedures that involve large incisions and substantial displacement of the rib cage are often traumatic to the patient with significant attendant risks. The recovery period may be extensive and is often painful. Furthermore, patients for whom coronary surgery is indicated may need to forego such surgery due to the risks involved with gaining access to the heart.

U.S. Pat. No. 5,503,617 to Jako discloses a retractor configured to be held by the surgeon for use in vascular or cardiac surgery to retract and hold ribs apart to allow access to the heart or a lung through an operating "window". The retractor includes a rigid frame and a translation frame slideably connected to the rigid frame. Lower and upper blades are rotatably mounted to the rigid frame and the translation frame respectively. The "window" approach enables the surgeon to gain access through a smaller incision and with less displacement of the ribs, and consequently, less trauma to the patient.

Once access to the thoracic cavity has been achieved, surgery on the heart may be performed. Some procedures require that the heartbeat be arrested while maintaining circulation throughout the rest of the body. Alternatively, the CABG procedure may be performed while the heart is permitted to beat. Such a procedure is now commonly referred to as minimally invasive direct coronary artery bypass (MIDCAB) when performed through a thoracotomy (when performed through a sternotomy, the procedure is commonly called open coronary artery bypass (OP-CAB)). A heart stabilizer, e.g., the stabilizer described in U.S. Pat. No. 5,947,896 entitled HEART STABILIZING APPARATUS AND METHOD FOR USE and U.S. Pat. Appl. Ser. No. _____ filed by Farascioni on October 13, 1999 entitled SURGICAL APPARATUS AND METHOD, along with other surgical instruments may be used to stabilize the heart and restrict blood flow through the coronary artery during the graft procedure.

During by-pass procedures, it is not uncommon for a surgeon to utilize several different instruments including several of the instruments described above, e.g., a retractor assembly (i.e., base/arms, blades and blade separating mechanism), heart stabilizer, instrument holder(s), suture holder, etc. Moreover, it is not uncommon for a surgeon to utilize different instruments from different manufactures due to particular preference or hospital guidelines. However, it has been seen that many of these surgical instruments are not compatible and/or interchangeable due to each instrument's particular size, profile/cross section and/or mounting appendages. As a result, the instruments may not cooperate in an efficient, practical or optimal manner thus forcing the surgeon to use compatible instruments manufactured by the same company.

For example, several different manufacturers make retractors which are designed to expose the thoracic cavity (either through a median sternotomy or by spreading the ribs to form a surgical window), however and as far as is known, these retractors are typically designed to cooperate with only those instruments manufactured by the same company. Again, this may hinder the surgeon who wishes to perhaps use a different, more effective instrument manufactured by a different company.

Thus, a need exists to develop a universal instrument base assembly which mounts atop a variety of different surgical retractors giving a surgeon the

option of using a variety of different surgical instruments manufactured by different companies.

SUMMARY

The present disclosure relates to a universal instrument base assembly which is selectively engageable with a surgical retractor which includes a mounting plate having at least one mechanical interface which releasably engages the surgical retractor and an instrument base plate having a first portion which releasably engages the mounting plate and a second portion which releasably engages a surgical instrument. Preferably, the mechanical interface of the mounting plate is dimensioned and/or is adjustable to releasably engage a variety of different surgical retractors.

In one embodiment, the mechanical interface includes a plurality of opposing flanges which downwardly depend from the mounting plate to engage the surgical retractor. Preferably, at least one of the flanges includes a locking pin or screw for securing the mounting plate to the surgical retractor.

In another embodiment, the mounting plate includes a plurality of opposing notches disposed therein which engage a corresponding plurality of opposing detents disposed on the instrument base plate. Preferably, the instrument base plate engages the mounting plate in a snap-fit manner.

In still another embodiment, the instrument base plate includes a pair of opposing flanges which project outwardly from opposite sides of the base plate and are dimensioned to engage/mount a surgical instrument. Preferably, the instrument base plate includes suture mounts for facilitating surgical procedures. In another embodiment, the instrument base plate includes a plurality of apertures for mounting a variety of different surgical instruments at various positions along the instrument base plate.

In yet still another embodiment, the instrument base plate is dimensioned to support an instrument holder. In another embodiment, a mounting bridge is supported between two universal instrument base assemblies and supports a surgical instrument at a substantially perpendicular angle relative to the two base assemblies. Preferably, the instrument holder and/or the mounting bridge include locking members, e.g., screws, tabs, or flanges, which selectively secure each of the same to the instrument base plate.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a universal instrument base assembly engaged atop an arm of a surgical retractor according to the present disclosure;

Fig. 2 is an exploded view of two universal instrument base assemblies engaged atop two opposing arms of a surgical retractor;

Fig. 3 is a top view of two universal instrument base assemblies engaged atop two opposing arms of a surgical retractor showing a surgical instrument engaged atop one of the universal instrument base assemblies;

Fig. 4 is a perspective view of two universal instrument base assemblies engaged atop two opposing arms of a surgical retractor showing a surgical instrument holder engaged atop one of the instrument base assemblies; and

Fig. 5 is a perspective view of two universal instrument base assemblies engaged atop two opposing arms of a surgical retractor showing an instrument mounting bridge and surgical instrument mounted between the two universal instrument base assemblies.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to Figs. 1-5 wherein like reference numerals identify similar or identical elements throughout the several views, a universal instrument base assembly 10 for use with a variety of different surgical retractors includes a mounting plate 30 and an instrument base plate 20 which are dimensioned to selectively engage a surgical retractor 40. More particularly and as best seen in Fig. 1, base assembly 10 is dimensioned to engage surgical retractor 40 such that surgical instruments, sutures and the like can be positioned and/or secured proximate the operating site to facilitate surgical procedures.

For the purposes herein, an Ankeny surgical retractor is shown throughout the several views by way of example and is intended to represent the state of the art. However, it is envisioned that the presently disclosed universal base assembly 10 can be used with a variety of different surgical retractors 40 of varying dimension and operation. Moreover, universal base assembly 10 is preferably dimensioned as a low profile mount for various instrumentation used in surgical procedures, e.g., instrument holders such as those described in U.S. Pat. Appln. Ser. No. 09/235,593 entitled SURGICAL INSTRUMENT HOLDER and the various surgical instrumentation described in U.S. Pat. No. 5,947,896 entitled HEART STABILIZER APPARATUS AND METHOD FOR USE and U.S. Pat. Appln. Ser. No. _____, filed by Farascioni on October 13, 1999 entitled SURGICAL APPARATUS AND METHOD, the entire contents of all are hereby incorporated by reference herein.

As best shown in Figs. 2 and 3, the Ankeny surgical retractor 40 includes a retractor base 56 having a pair of arms 41a and 41b which project generally perpendicularly therefrom. Arm 41a is fixed to base 56 whereas arm 41b is selectively movable relative to retractor base 56 and arm 41a by a ratchet assembly 50. Each arm 41a, 41b also includes a plurality of retractor blades 44a and 44b, respectively, which depend from a distal end of each arm 41a, 41b into the surgical incision 90. Movement of arm 41b relative to arm 41a biases the plurality of opposing blades 44a and 44b against each other causing the surgical incision 90 to spread apart. Preferably, each retractor blade 44a, 44b is generally C-shaped

and includes an inwardly projecting flange 45a and 45b, respectively, which helps maintain the sides of the incision 90, internal tissue and bone in a spread apart manner during the course of the surgical procedure. It is also envisioned that each retractor blade 44a, 44b is selectively adjustable and/or selectively removable by way of screws 43a, 43b.

As best shown in Fig. 3, ratchet assembly 50 includes a lever arm 52 which selectively advances a pawl (not shown) in discrete movements along a plurality of teeth 54 disposed along the retractor base 56. This permits incremental retraction of the incision 90, rib or other body structure and prevents slipping of or loss of retraction force during the surgical procedure.

As best shown in Fig. 2, mounting plate 30 is dimensioned to selectively engage an arm 41a, 41b of the retractor 40. More particularly, mounting plate 30 includes a plurality of opposing flanges 33 and 36 which downwardly depend from opposite sides of the mounting plate 30 and are dimensioned to releasably engage opposing sides of a retractor arm, e.g., 41a. Preferably, at least one of the flanges, e.g., 33, includes a locking pin or screw 34 which biases the flanges, e.g., 36, located on the opposite side of the mounting plate 30 to secure the mounting plate 30 to the arm 41a. It is envisioned that the flanges 33, 36 can be moveable (either vertically, horizontally and/or radially) relative to the mounting plate 30 to accommodate a variety of different surgical retractors. It is also envisioned

that locking pin(s) or screw(s) 34 can be dimensioned to accommodate retractors 40 having varying widths.

Mounting plate 30 also includes a plurality of mechanical interfaces or notches 31 and 37 which are dimensioned to releasably engage corresponding detents or tabs 21 and 27, respectively, located on the instrument base plate 20 in a snap-fit manner. In addition, mounting plate 30 also includes a pair of apertures 32 located on opposite ends thereof which align with a corresponding pair of locking pins or screws 22 disposed on opposite sides of the instrument base plate 20. It is envisioned that screws 22 engage apertures 32 and lock the two components 20 and 30 together atop the surgical retractor 40.

Base assembly 10 also includes an instrument base plate 20 which is dimensioned to selectively engage mounting plate 30. More particularly and as mentioned above, instrument base plate 20 includes a plurality of detents or tabs 21 and 27 which selectively engage a plurality corresponding notches 31 and 37, respectively, defined within mounting plate 30. In addition, instrument base plate 20 includes a pair of locking pins or screws 22 which couple with corresponding apertures 32 to releasably lock the two components 20 and 30 together atop the retractor 40.

As best seen in Figs. 1, 4 and 5, instrument base plate 20 engages mounting plate 30, however, it is envisioned that instrument base plate 20 can

partially encompass mounting plate 30 (or vice versa) to reduce the overall profile of the base assembly 10. Moreover, it is envisioned that any combination of mechanical interfaces may be utilized between the instrument base plate 20 and mounting plate 30 to engage the two components 20 and 30. Instrument base plate 20 also includes a pair of opposing flanges 25 and 29 located along the inner and outer periphery of the instrument base plate 20, respectively. Each of these flanges 25 and 29 is dimensioned to facilitate quick and precise alignment and engagement of surgical instrumentation to the instrument base plate 20. For example and as best shown in Fig. 4, an instrument holder 60 can be quickly and easily mounted atop the instrument base plate 20. More particularly, the instrument holder 60 includes a mounting bracket 62 and a movable flange 64 which cooperate to engage opposing flanges 29 and 25 of the instrument base plate 20 and secure the instrument holder 60 atop the instrument base plate 20. It is envisioned that other surgical instruments may be engaged atop the instrument base plate 20 in a similar manner. Instrument holder 60 also includes an adjustment arm 63 which is slideably mounted atop mounting bracket 62. A set screw 67 disposed within a slot 65 located in adjustment arm 63 secures the position of the adjustment arm 63 relative to the mounting bracket 62 and the surgical site.

It is envisioned that the position of a particular surgical instrument can be easily manipulated around the surgical site. For example and as best shown in Fig. 4, a heart stabilizer 70 can be selectively moved to various positions along base assembly 10 by way of moving instrument holder 60 along the instrument base plate

20. The height of the stabilizer 70 can also be selectively adjusted by loosening set screw 61 and sliding bar 74 to a desired height. When sufficient pressure is placed on the heart to substantially stabilize the heart, the stabilizer 70 is secured by tightening the screw 61 against bar 74. Heart movement is restricted by virtue of the leg pressure and the anti-slip texture of the legs 72a, 72b. It is envisioned that a variety of surgical instruments can be slideably received within adjustment arm 63 in much the same manner as the heart stabilizer 70 to accomplish a particular surgical purpose.

Turning back to Fig. 2, instrument base plate 20 also includes a plurality of suture mounts 26 defined therein which serve as attachment and/or anchor points for suture ends from the surgical field. It is envisioned that each suture mount 26 includes a tightly wound spring 17 located within the suture mount 26 which operates to releasably retain each suture (not shown) during a surgical procedure. A triangular ramp 19 is formed on the inner surface of the suture mount 26 and a notch or slit 23 is formed on the outer surface of the suture mount. This ramp 19 and slit 23 arrangement facilitates easy positioning of the sutures within the spring 17. Other suture mounts may also be employed such as those described in U.S. Pat. No. 5,947,896 and U.S. Pat. Appln. Ser. No. _____ filed by Farascioni mentioned above.

It is also envisioned that other surgical instruments may be engaged atop instrument plate 20 in a different manner, e.g., by engaging one or more of the

suture mounts 26 or apertures 28 located within the instrument base plate 20 as described in detail with respect to the various surgical instruments disclosed in U.S. Pat. No. 5,947,896 and U.S. Pat. Appln. Ser. No. _____ filed by Farascioni mentioned above.

As best shown in Fig. 5, a mounting bridge 80 may also be employed over the surgical site between two universal base assemblies 10. Mounting bridge 80 includes a top face 83 having a pair of opposing flanges 86 and 88 which are dimensioned to engage a surgical instrument, e.g., instrument holder 60, in much the same manner as described above with respect to the instrument base plate 20. A pair of set screws 82 is located within a slot 84 disposed within face 83 which lock the mounting bridge 80 and, therefore, the surgical instrument, in a desired position between base assemblies 10. As can be appreciated from the present disclosure, the mounting bridge 80 enables a surgeon to support various and/or additional surgical instruments at a generally perpendicular orientation relative to the base assemblies 10 and retractor arms 41a, 41b.

Preferably, set screws 82 engage aperture 28 disposed within instrument base plate 20, however, it is envisioned that mounting bridge 80 can engage instrument base plate 20 in a different manner, e.g., in a similar manner as described above with respect to the instrument holder 60. Moreover, it is also envisioned that the set screws 82 can be moved from a first position wherein the set screws 82 secure the mounting bridge 80 atop the instrument base plate 20 but

permit the mounting bridge 80 to slide between the universal base assemblies 10 to a second position which locks the mounting bridge 80 relative to the instrument base plate 20.

From the foregoing and with reference to the various figure drawings, those skilled in the art will appreciate that certain modifications can also be made to the present disclosure without departing from the scope of the present disclosure. For example, although the mounting plate 30 and instrument base plate 20 have been illustrated as rectilinear, each of these components may be shaped differently according to the particular profile of a surgical retractor. Alternatively, the mounting plate may be shaped according to the profile of the surgical retractor and the instrument base plate may be a different shape with corresponding mechanical interfaces to ensure engagement with the mounting plate.

It may also be preferably to manufacture the mounting plate and/or the instrument base plate with adjustable mechanical interfaces to accommodate a wider variety of surgical retractors and/or surgical instruments. Moreover, it may be desirable to manufacture the mounting plate and instrument base plate from a semi-pliable material which conforms to the particular profile of the surgical retractor.

While several embodiments of the disclosure has been described herein, it is not intended that the disclosure be limited thereto, as it is intended that the disclosure be as broad in scope as the art will allow and that the specification be

read likewise. For example, although the preferred embodiments described herein have been described in terms of apparatus relating to heart surgery, the subject matter should not be limited thereto. The present disclosure may find application in surgery wherein access to the surgical site is achieved through a smaller incision wherein smaller retractors and/or smaller surgical instruments are utilized.

Therefore, the above description should not be construed as limiting, but merely as exemplifications of a preferred embodiment. Those skilled in the art will envision other modifications within the scope and spirit of the claims appended hereto.

WHAT IS CLAIMED IS:

1. A universal instrument base assembly which is selectively engageable with a surgical retractor, comprises:
 - a mounting plate having at least one mechanical interface which releasably engages the surgical retractor;
 - an instrument base plate having a first portion which releasably engages the mounting plate and a second portion which releasably engages a surgical instrument; and
 - wherein the at least one mechanical interface is dimensioned to selectively engage a variety of different surgical retractors.
2. A universal instrument base assembly according to claim 1 wherein the at least one mechanical interface of the mounting plate is selectively adjustable.
3. A universal instrument base assembly according to claim 1 wherein the at least one mechanical interface includes a plurality of opposing flanges which downwardly depend from the mounting plate and engage the surgical retractor.

4. A universal instrument base assembly according to claim 3 wherein at least one the flanges includes a locking screw for selectively securing the mounting plate to the surgical retractor.
5. A universal instrument base assembly according to claim 1 wherein the instrument base plate includes at least one mechanical interface for selectively securing the instrument base plate to the mounting plate.
6. A universal instrument base assembly according to claim 1 wherein the instrument base plate engages the mounting plate in a snap-fit manner.
7. A universal instrument base assembly according to claim 1 wherein the mounting plate includes at least one notch disposed therein which engages at least one corresponding detent disposed on the instrument base plate.
8. A universal instrument base assembly according to claim 7 wherein the mounting plate includes a plurality of opposing notches disposed therein which engage a corresponding plurality of opposing detents disposed on the instrument base plate.
9. A universal instrument base assembly according to claim 5 wherein the mechanical interface on the instrument base plate includes a locking screw.

10. A universal instrument base assembly according to claim 1 wherein the instrument base plate includes a flange which projects outwardly therefrom, the flange being dimensioned to engage the surgical instrument.
11. A universal instrument base assembly according to claim 1 wherein the instrument base plate includes a plurality of flanges which project outwardly from opposite sides of the instrument base plate, the flanges being dimensioned to engage opposite sides of the surgical instrument.
12. A universal instrument base assembly according to claim 1 wherein the instrument base plate includes a plurality of suture mounts disposed thereon.
13. A universal instrument base assembly according to claim 11 wherein the instrument base plate is dimensioned to selectively engage a surgical instrument holder.
14. A universal instrument base assembly according to claim 13 wherein the instrument holder includes a base having first and second opposing flanges which are dimensioned to engage the flanges of the instrument base plate.
15. A universal instrument base assembly according to claim 14 wherein one of the flanges of the instrument holder is selectively movable relative to the other of the flanges of the instrument holder.

16. A universal instrument base assembly according to claim 1 wherein the instrument base plate is dimensioned to selectively engage one end of an instrument mounting bridge.
17. A universal instrument base assembly according to claim 16 wherein the instrument mounting bridge is engaged between two universal instrument bases.
18. A universal instrument base assembly according to claim 17 wherein the instrument mounting bridge is dimensioned to support a variety of different surgical instruments between the universal instrument bases.
19. A universal instrument base assembly according to claim 17 wherein the mounting bridge is selectively movable relative to the universal instrument bases.
20. A universal instrument base assembly according to claim 19 wherein the instrument mounting bridge includes at least one locking member which fixes one of the universal instrument bases relative to the other.

21. A universal instrument base assembly according to claim 19 wherein the instrument mounting bridge includes two locking members which fix the mounting bridge relative to each universal instrument base.

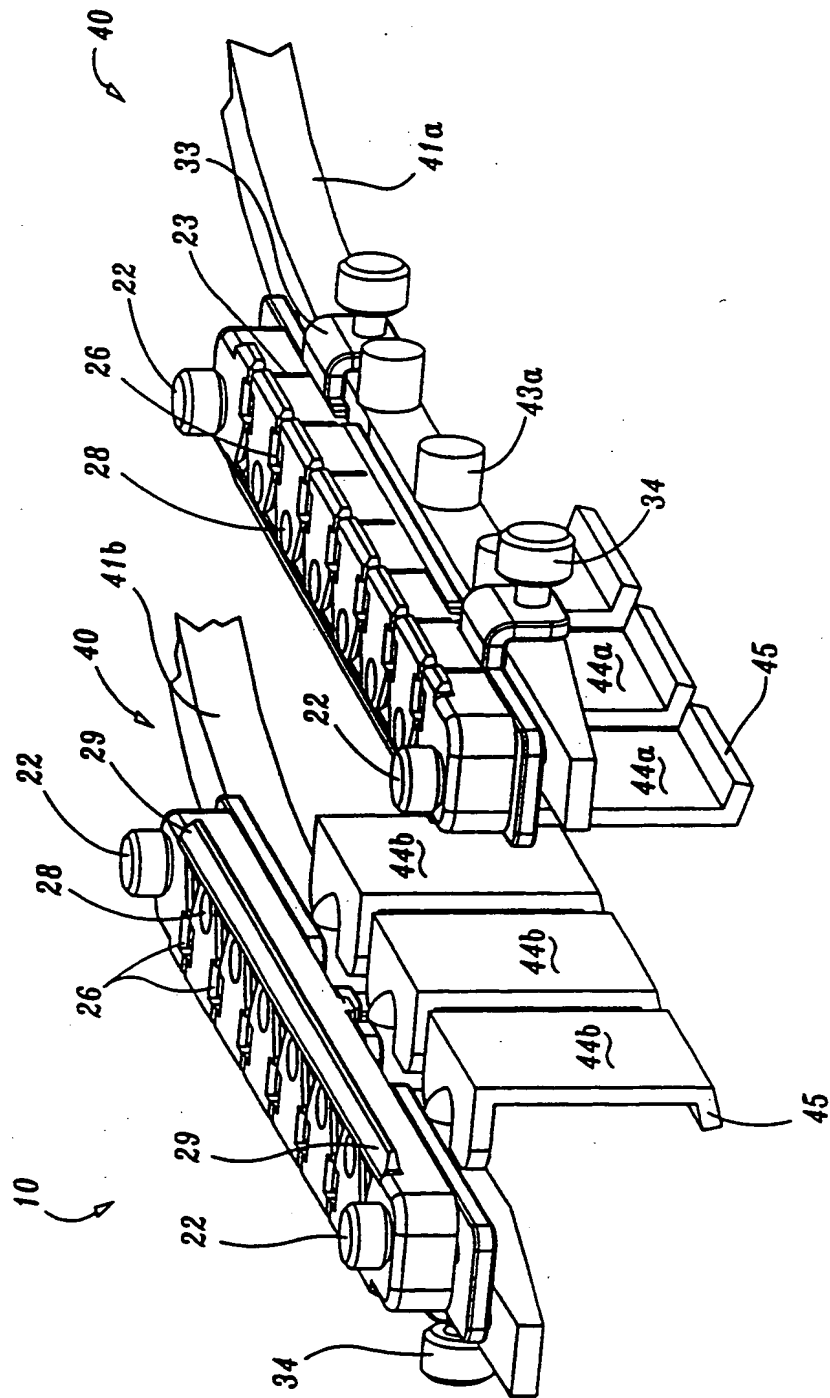


FIG. 1

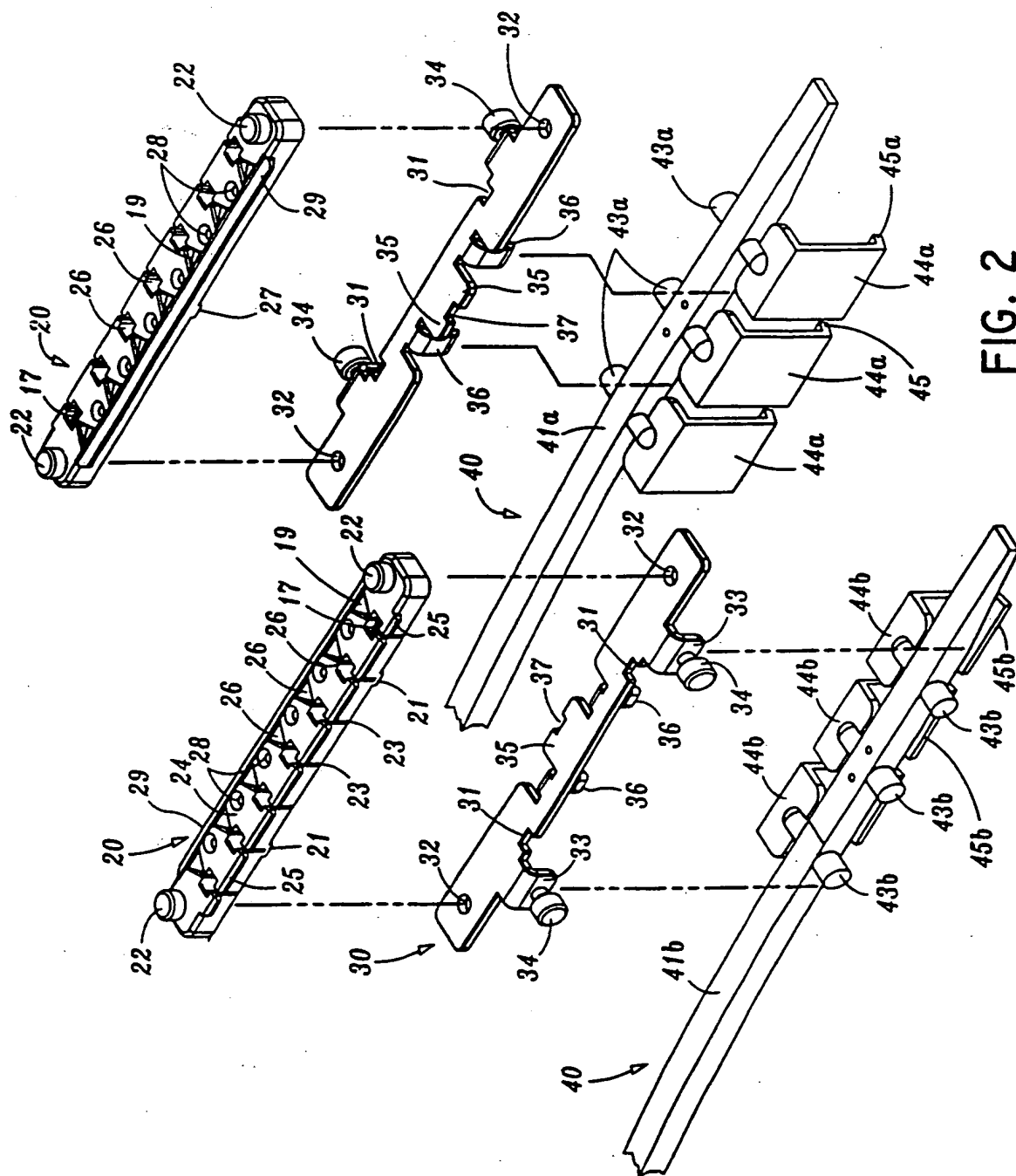


FIG. 2

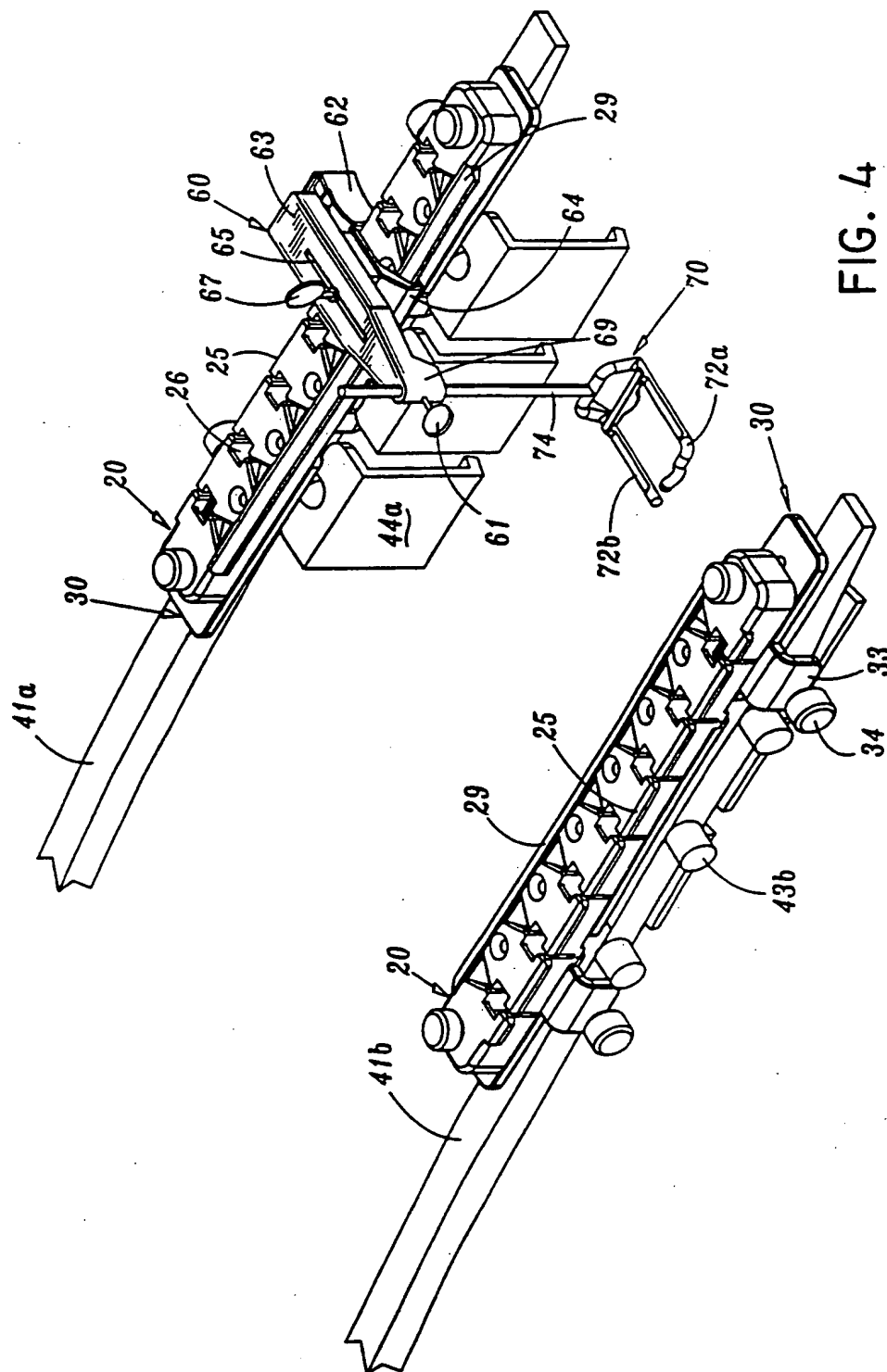


FIG. 4

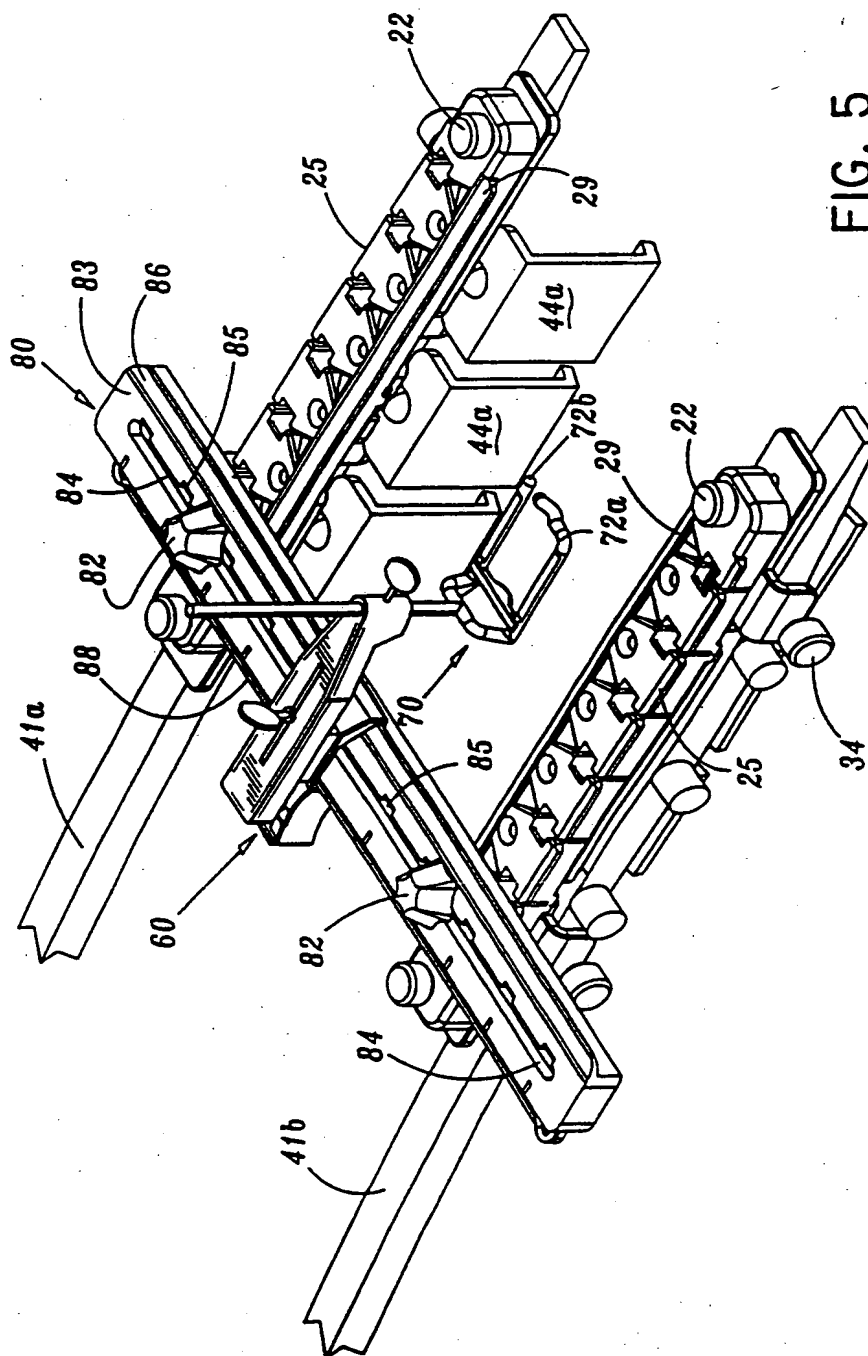


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/33384

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : A61B 1/32

US CL : 600/227

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 600/227, 228, 229, 231, 232, 233, 234, 235, 201

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,384,077 A (GAUTHIER) 21 May 1968, entire document.	1-20N
X	US 4,702,230 A (PELTA) 27 October 1987, entire document.	1-3, 5, 6, 10, 16-20
Y		11, 13-15
A	DE 297 07 567 U1 (REISS) 14 August 1997, Fig. 5.	1-20
A	US 5,885,271 A (HAMILTON et al.) 23 March 1999, Fig. 10.	1-20
A, P	US 6,056,689 A (LENOX et al.) 02 May 2000, Fig. 24.	1-20

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents.	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*G* document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means	
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

12 FEBRUARY 2001

Date of mailing of the international search report

26 MAR 2001

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

JEFFREY A. SMITH

Telephone No. (703) 308-0858